

## **TITLE OF THE INVENTION**

### **GOLF CLUB HEAD**

## **BACKGROUND OF THE INVENTION**

### **FILED OF THE INVENTION**

The present invention relates to a golf club head and more particularly to a golf club head in which a high rebounding performance is applied to the face plate of a head such as a driver, a spoon, a baffy and the like.

### **RELATED ART**

Japanese Patent Application Laid-Open No. 2002-320692 discloses a golf club head in which semi-circular reinforcing wire rods are radially arranged around a hitting spot on a back side (inner surface) of a face plate of a head, and the reinforcing wire rods are integrally provided to an inner surface of the face plate. When a golf ball is caught at the face area excluding the hitting spot, it can hardly be said that this effect can be obtained properly.

Moreover, since this golf club head is designed such that the reinforcing wire rods are integrally extended on the inner surface of the face plate for reinforcement, the reinforcing wire rods are normally restrained by the face plate and it is practically impossible for the reinforcing wire rods to be flexed independently freely and to offer the high rebounding performance.

Moreover, in the above-mentioned related art, it seems that the reinforcing wire rods are adhered to the inner surface of the face plate by

using adhesive agent and therefore, there is a fear that the wire rods are liable to be peeled off and dropped. Since the face plate, in particular, is flexed inward whenever it strikes the golf ball, the problem of the wire rods being peeled off and dropped becomes more serious.

The present invention has been accomplished in view of the above-mentioned problems.

## SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a golf club head in which a face plate is designed as thinner as possible to increase an amount of flexure and in which the face plate co-acts with elastic wire rods arranged in parallel relation on the face plate so as to effectively provide a high rebounding performance at the time of hitting a gold ball, thereby extensively increasing a driving distance of the golf ball under the so-called trampoline effect.

To achieve the above object, there is essentially provided a golf club head comprising a plurality of elastic wire rods arranged in parallel relation along an inner surface of a face plate, the elastic wire rods being extended in contact with the inner surface of the face plate or with a small space formed between the inner surface of the face plate and the elastic wire rods, opposite ends of the elastic wire rods being fixed to a peripheral part of the face plate, so that free elastic displacement is allowed between the fixed opposite ends.

The elastic wire rods arranged in parallel relation along the inner surface of the face plate exhibits a high rebounding performance at a wide

area including the hitting spot of the face plate so that a driving distance can be increased. Moreover, by designing the face plate thinner, the rebounding performance is increased. By virtue of the foregoing arrangement, the so-called trampoline effect can effectively be obtained.

Since the elastic wire rods are allowed to extend along the inner surface of the face plate in such a manner as to contact therewith or with a small space formed between the inner surface of the face plate and the elastic wire rods, the elastic wire rods are freely flexed with respect to the face plate so that a high rebounding force is exerted to the face plate. Owing to the foregoing arrangement, the elasticity of the elastic wire rods can effectively contribute to increase the driving distance.

Moreover, since the load caused by the flexure of the elastic wire rods is incurred to the fixed opposite ends, the problem of peel-off of the elastic wire rods, etc. can be overcome.

As one suitable example, the opposite ends of the elastic wire rods are fixedly adhered or welded to a front edge part of a head main body. Owing to the foregoing arrangement, a free elastic displacement is allowed between the fixed opposite ends.

As the elastic wire rods, metal wire rods such as steel wire rods, as represented by piano wires, are suitably used.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a golf club head with elastic wire rods laterally arranged in parallel relation, from which a face plate has already been removed.

FIG. 2 is a vertical sectional view of the golf club head of FIG. 1.

FIG. 3 is a cross sectional view of the golf club head of FIG. 1.

FIG. 4 is a front view of a golf club head with elastic wire rods vertically arranged in parallel relation, from which a face plate has already been removed.

FIG. 5 is a vertical sectional view of the golf club head of FIG. 4.

FIG. 6 is a cross sectional view of the golf club head of FIG. 4.

FIG. 7 is a front view of a golf club head with elastic wire rods vertically and horizontally arranged in parallel relation, from which a face plate has already been removed.

FIG. 8 is a vertical sectional view of the golf club head of FIG. 7.

FIG. 9 is a cross sectional view of the golf club head of FIG. 7.

FIG. 10 is a cross sectional view of a golf club head showing one example of a fitting structure for fitting a face plate to a head main body and an attaching structure of elastic wire rods.

FIG. 11 is a vertical sectional view of a golf club head showing fixedly positioning grooves formed at opposite ends of elastic wire rods of FIG. 10.

FIG. 12 is a cross sectional view of a golf club head showing one example in which a face plate of the golf club head is in the shape of a cup.

FIG. 13 is a vertical sectional view of a golf club head showing fixedly positioning grooves formed at opposite ends of elastic wire rods of FIG. 12.

FIG. 14 is a cross sectional view of a golf club head showing one example in which a swollen part is disposed at an inner surface of a face

plate, and elastic wire rods are arranged in parallel relation.

FIG. 15 is a sectional view of an essential part showing one example in which a knurl is formed on each end of each elastic wire rod and fixed thereto.

FIG. 16 is a sectional view of an essential part showing another example in which a knurl is formed on each end of each elastic wire rod and fixed thereto.

FIG. 17 is a sectional view of an essential part showing a contact arrangement structure of the elastic wire rods which are in contact with the face plate.

FIG. 18 is a sectional view of an essential part showing a non-contact arrangement structure of the elastic wire rods which are in non-contact with the face plate.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention, i.e., the best mode for carrying out the present invention will now be described with reference to FIGS. 1 through 18.

As typically shown in FIGS. 2, 5 and 8, a metal-made head main body 1 of a golf club is of hollow structure, and an opening disposed at its front surface is closed with a face plate 2 which is made of metal such as titanium. That is, the head main body 1 and the face plate 2 are designed as separate parts, and the face plate 2 is attached to a front edge part of the head main body 1 by welding or the like, thereby forming a hollow structure.

As typically shown in FIGS. 1, 4 and 7, a plurality of elastic wire rods 3 are arranged in parallel relation along an inner surface of the face plate 2 and the elastic wire rods 3 are extended in contact with the inner surface of the face plate 2 as shown in FIG. 17. That is, the elastic wire rods 3 and the inner surface of the face plate 2 form a free contact surface.

The elastic wire rods 3 are in contact with the face plate 2 over its generally entire width. It is also an interesting alternative that, as shown in FIG. 14, a swollen part 11 is integrally formed on a central part of the inner surface of the face plate 2, the elastic wire rods 3 are extended in contact with the swollen part 11, and opposite ends of the elastic wire rods 3 are spaced apart from the inner surface of the face plate 2.

The swollen part 1 forms a hitting spot. When this swollen part 11 is flexed inward, pressure is concentrated on the central parts of the elastic wire rods 3 to flex the elastic wire rods inward together.

As shown in FIG. 18, the elastic wire rods 3 are extended with a small spaced formed between the inner surface of the face plate 2 and the elastic wire rods 3. That is, the elastic wire rods 3 are extended with a small space formed between the inner surface of the face plate 2 and the elastic wire rods 3 such that during the process the face plate 2 is flexed inward, the face plate 2 is contacted with the elastic wire rods 3 and flexed together with the rods 3.

In case the swollen part 11 is disposed at the inner surface of the face plate 2 as shown in FIG. 14, the elastic wire rods 3 are extended at their central parts with a small space 4 formed between the inner surface of the face plate 2 and the elastic wire rods 3 as shown in FIG. 18 and

normally held in non-contact relation with the inner surface of the face plate 2 so that the swollen part 11 is contacted with and flexed together with the elastic wire rods 3 during the process the face plate 2 is flexed inward.

In either case where the elastic wire rods 3 are extended in contact with the inner surface of the face plate 2 or where the rods 3 are extended with the small space 4 formed between the inner surface of the face plate 2 and the rods 3, the opposite ends of the elastic wire rods 3 are fixed to a peripheral part of the face plate 2.

In other words, the opposite ends of the elastic wire rods 3 are fixed to the peripheral part of the face plate 2, so that the elastic wire rods 3 are extended in their free states with respect to the inner surface of the face plate 2 between the two fixed parts. That is, the elastic wire rods 3 are extended in contact with the inner surface of the face plate 2 or with the small space 4 formed between the inner surface of the face plate 2 and the rods 3 between the opposite fixed ends.

When a golf ball is struck with an outer surface of the face plate 2, the face plate 2 is flexed inward. At that time, the elastic wire rods 3 are flexed inward together with the face plate 2 during the process the face plate 2 is flexed, thereby synergistically generating a rebounding force.

As one mode of parallel arrangement of the elastic wire rods 3, the rods 3 are laterally (generally horizontally) arranged in parallel relation as shown in FIGS. 1 through 3. As another mode, the elastic wire rods 3 are vertically (in the up and down direction) arranged in parallel relation as shown in FIGS. 4 through 6. As still another mode, the elastic wire rods 3

are laterally and vertically arranged in parallel relation as shown in FIGS. 7 through 9. The lateral and vertical elastic wire rods 3 are intersected and contacted with each other.

As the elastic wire rods 3, steel wire rods such as the known piano wires are used. Otherwise, as the elastic wire rods 3, the known carbon wire rods, i.e. wire rods composed of carbon fibers or wire rods composed of boron are used.

As one example for fixing the opposite ends of the elastic wire rods 3, the opposite ends of the elastic wire rods 3 inserted in positioning grooves 3 or holes which are spacedly arranged at a front edge part of the head main body 1 and fixed thereto by welding or adhesive agent, as shown in FIGS. 1 through 3.

That is, the positioning grooves 5 or holes are spacedly arranged at the front edge part of the head main body 1 which is jointed with the peripheral edge part of the face plate 2, the opposite ends of the elastic wire rods 3 are inserted in the respective positioning grooves 5 or holes, and the opposite ends of the elastic wire rods 3 are fixed to the inner peripheral surfaces of the positioning grooves 5 or holes by adhesive agent or welding, thereby forming an integral structure.

It is also an interesting alternatives that as shown in FIGS. 10 and 11, the face plate 2 is fitted to the opening part disposed at the front surface of the head main body 1, and the peripheral edge part is welded thereto, thereby forming a hollow structure. And the positioning grooves 5 or holes are spacedly arranged at a stepped surface 6 formed at the inner surface of the front edge part, i.e., inner peripheral surface of the opening



part of the front surface of the head main body 1, and the opposite ends of the elastic wire rods 3 are inserted in the grooves 5 or holes and fixed thereto by adhesive agent or welding. The elastic wire rods 3 are laterally and/or vertically arranged. The inner surface at the peripheral edge part of the face plate 2 is supported by and welded to the stepped surface 6.

In case the positioning grooves 5 or holes are opened at the inside and outside of head main body 1, the opening on the outer surface side of the head main body 1 is closed with a coating material.

Also, as shown in FIGS. 12 and 13, a standing wall 8 is integrally formed on the peripheral edge part of the face plate 2 so as to form a shape of a cup. An end face of the standing wall 8 of the cup-shaped face plate 2 and the front end face of the head main body 1 are abutted with each other and welded together to form a hollow structure. The positioning grooves 5 or holes are spacedly arranged at an end face of the standing wall 8, the opposite ends of the elastic wire rods 3 are inserted in the grooves 5 or holes and fixed to the inner surfaces of the positioning grooves 5 or holes by adhesive agent or welding, and the elastic wire rods 3 are laterally and/or vertically arranged.

Although not shown, the positioning grooves 5 or holes are spacedly arranged at a front end face of the head main body 1 confronting the end face of the standing wall 8 of the cup-shaped face plate 2, the opposite ends of the elastic wire rods 3 are inserted in the grooves 5 or holes and fixed to the inner surfaces of the grooves 5 or holes, and the wire rods 3 are laterally and/or vertically arranged.

The cup-shaped face plate 2 effectively generates a rebounding

force, i.e., flexure of the face plate 2, and the elastic wire rods 3 co-acts with this cap-shaped face plate 2 to remarkably increase the rebounding force of the face plate 2.

As shown in FIGS. 15 and 16, the elastic wire rods 3 are provided at each opposite end thereof with a knurl 9 so that a binding force can be increased with respect to the adhesive agent or welding metal. Moreover, as shown in FIG. 16, each opposite end of each elastic wire rod 3 is bent to form an L-shape, the bent end part 10 is provided with a knurl 9, and the bent end part 10 is engaged in a positioning groove 5' which is opened at a front edge part of the head main body 1 and fixed thereto by welding or adhesive agent.

The present invention includes not only a case where the elastic wire rods 3 are arranged in parallel relation or vertically with respect to the ground surface but also a case where the elastic wire rods 3 are arranged diagonally with respect to the ground surface.

According to the present invention, the face plate 2 is designed as thinner as possible to increase an amount of flexure and in which the face plate 2 co-acts with elastic wire rods 3 arranged in parallel relation so as to effectively provide a high rebounding performance at the time of hitting a gold ball, thereby extensively increasing a driving distance of the golf ball under the so-called trampoline effect.